CHNOLOGY DEPT

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. L
No. 1294

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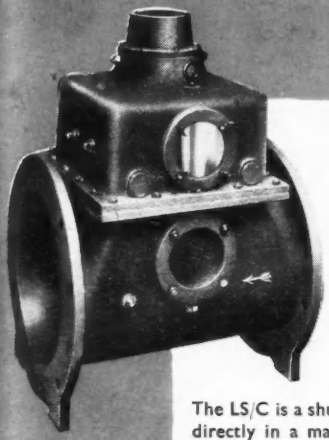

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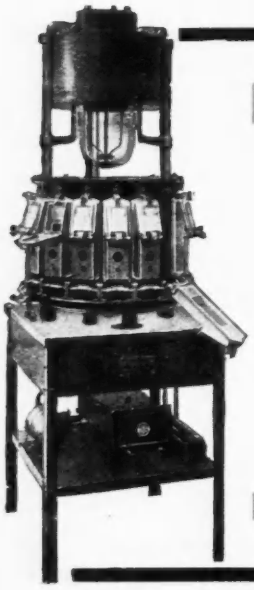

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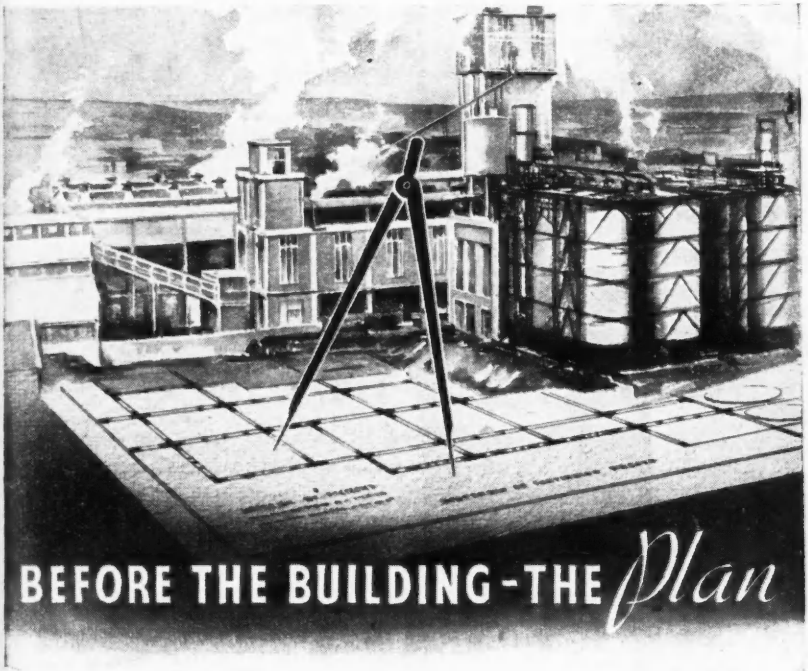

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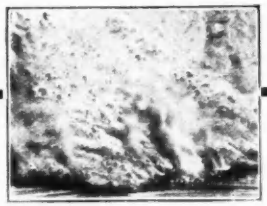

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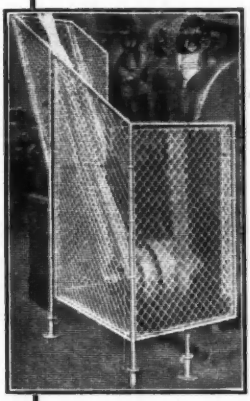

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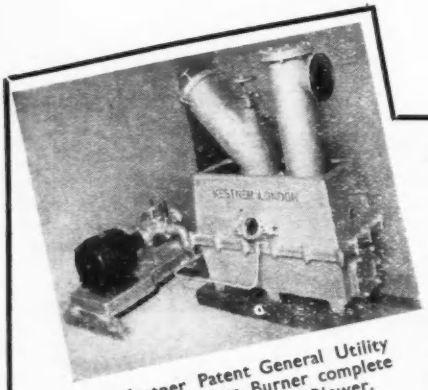

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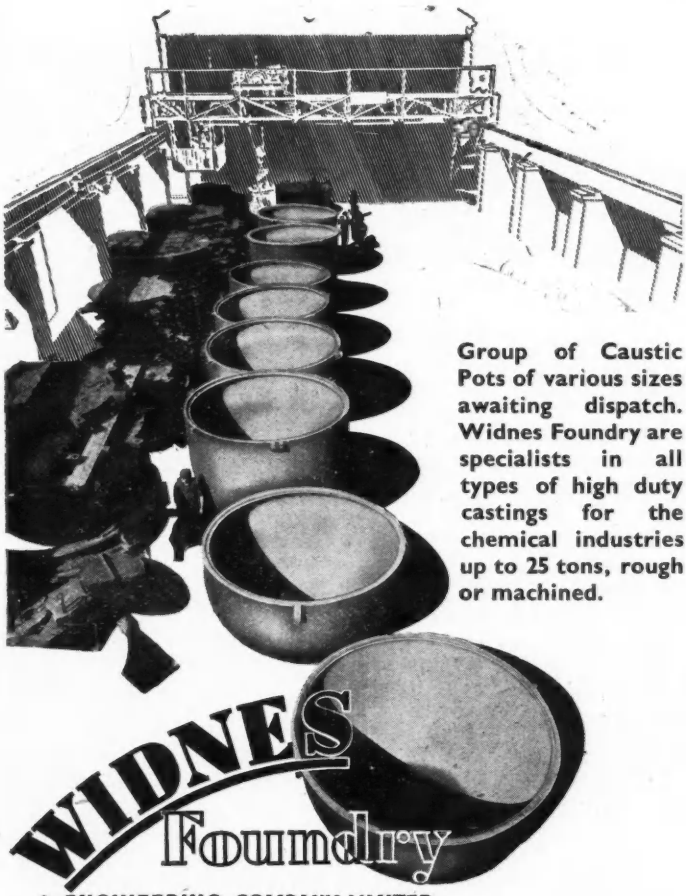

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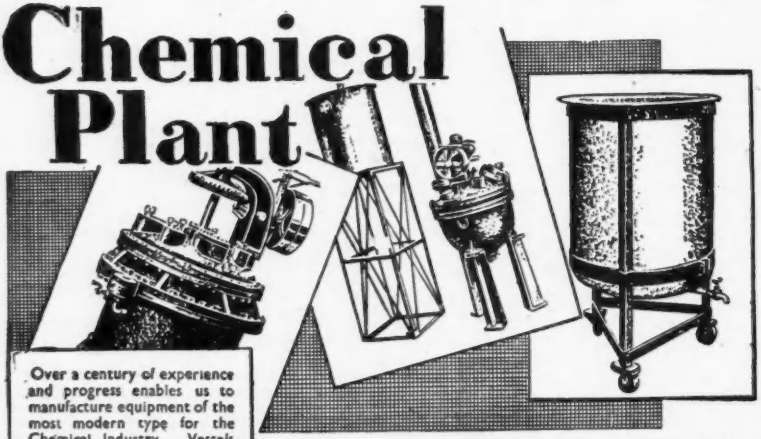

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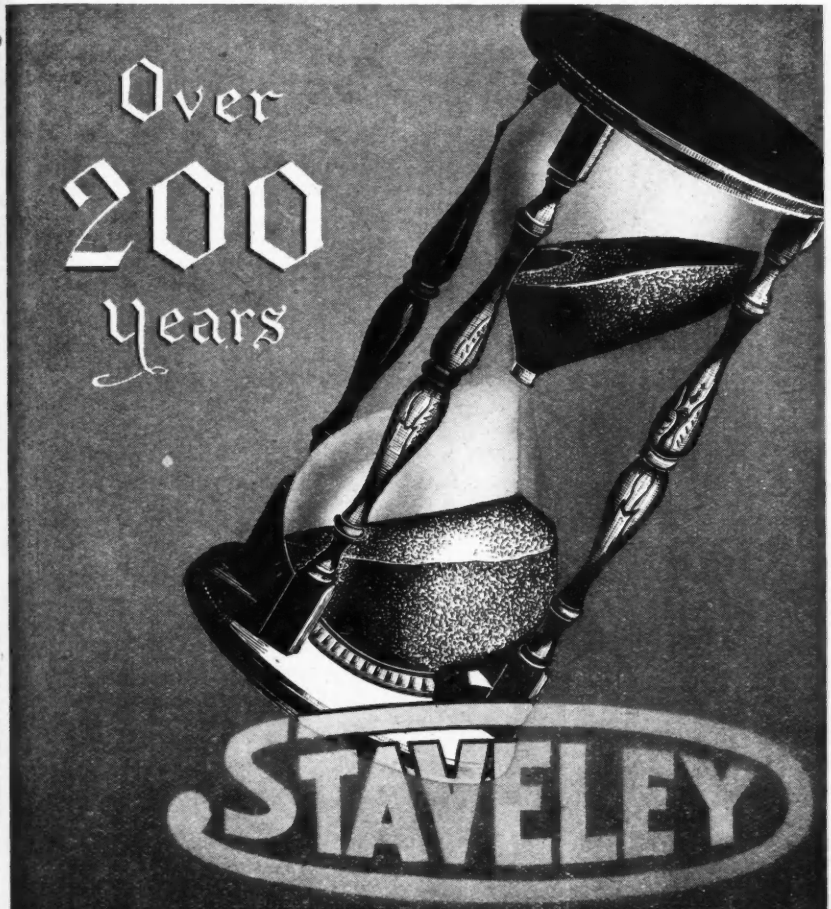

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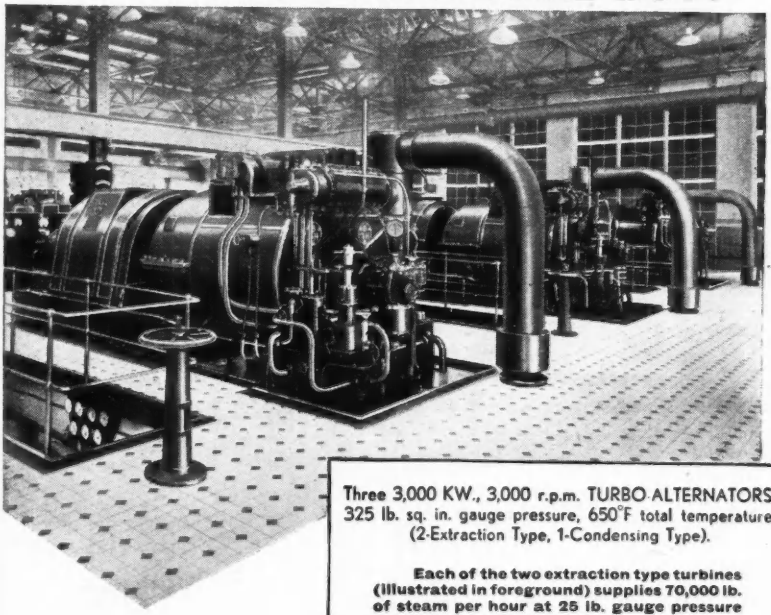

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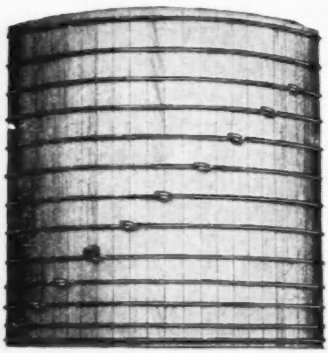

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April 15, 1944

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Who Makes Discoveries?

THE public is a great believer in hero-worship. Mankind still retains something of the child in him and just as the traditions and folklore of every nation are full of the wonderful deeds of heroes (who have sometimes been elevated by their descendants to the rank of gods and goddesses) so we are still disposed to regard all human events in terms of the principal personalities connected with them. Our wrath against Germany just now is concentrated on Hitler and one or two other figureheads, regardless of the fact that these men could not have led their nation into war against the world unless the nation had willed it so.

Hero-worship is fostered by the daily press because names make news and extreme accuracy is of less value than sensationalism. Thus it often happens that a particular individual is associated with a discovery in which his part was comparatively minor in relation to the whole effort required. When we ask, therefore, who makes discoveries, meaning thereby discoveries that are of value to the human race, we have to define what we mean by discoveries. From the point of view of the daily press and of the scientific textbook, the discoverer of any new thing is the man who first noticed it. It may have been nothing more than a lucky chance, as in the classical instance where the breaking of a thermometer led to the presence of mercury in a certain solution. That lucky chance led to events of world-wide importance and the "discovery" of it will be for ever associated with the name of the man, one Herr Sapper, who happened to be performing the experiment when the thermometer broke. The dyestuffs discoveries of Caro are full of happy accidents. The discovery of the healing qualities of penicillin was another lucky chance which befell one individual, and Professor Fleming is named as the benefactor of the whole human race, though Professor Florey was largely responsible for the development of the process of manufacture. Let us pay due honour to these discoverers who have had the vision to note what was happening when others would have passed it by and would have impatiently thrown the whole solution or culture away as an experiment gone wrong. But let us not forget that between a chance observation, however valuable, and its metamorphosis into

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something of value to the human race there has been a chain of individual effort which the original discoverer would have been unable to follow up either because of his lack of expert knowledge of the plant and methods involved or because of the physical impossibility of undertaking the extensive development work required. Thus it is that although in its hero-worship the world may point out an individual as the man who first thought of the idea, the discovery of the material, appliance, or whatever it may be, in a form suitable for mankind to use, has generally been the work of a team.

In a recent Parliamentary debate an honourable member claimed in regard to medical research and medical advance that "much as has been done by organisation, vastly more has been done by the discoveries of individual men. This is a profession," he said, "where science advances by the endeavours of the individual." To make this statement is to ignore the vast mass of organised research that is being conducted in all parts of the world on all manner of medical subjects, including the applications of chemistry as medicine. It is difficult to escape the conclusion that all research discoveries are the result of team work. The team may be totally unknown to each other and may not be working together, but there comes a little enlightenment from the U.S.A., a publication from Russia, a curious observation in China, an obscure paper in some medical journal in the Balkans, and ultimately someone who happens to be working in this field adds up the sum of the human knowledge thus made and announces "A Discovery." When that discovery is made it must be tried and its trial is usually again the result of team work in many lands. Frequently it requires considerable modification before it can be applied successfully; frequently it is only a partial success; but ultimately the technique is discovered and medicine advances another stage.

There are many sciences other than medicine in which advances are made by individuals along these lines. There are others, however, particularly chemistry and engineering, in which team work has advanced to a much higher pitch. Research associations are an example that immediately springs to the mind. There a team of men works on a particular problem and portions of that problem are probably put out to universities and to industrial laboratories. Papers are published showing the progress made. A suggestion comes from here, an observation from there, and little by little a new process is built up. Years of development work are often needed between the first promising observation (popularly called a "discovery") in a chemical laboratory, and the successful development of the process on a commercial scale. The manufacture of artificial silk and of artificial rubber come to mind as examples of successful team work in this field.

Much is written to-day about the need for scientific research and a good deal of nonsense unfortunately accompanies the grain of truth. It is not denied that we have giants among us at all times: men who can induce enthusiasm in their colleagues, who can see a little farther than their neighbours, and can make helpful suggestions towards the solution of intractable problems. We have a comparatively limited supply of these men and they are valuable. In considering scientific research of the future, however, and particularly industrial research, we ask the public to recognise that *all* the credit should not be given to the man who makes the first observation. It is not unknown for the man with the name to take the credit for whatever is done in his laboratory, whereas in fact he has been nothing more than the leader of an able and enthusiastic team. In saying this we are casting no aspersions on the inventors of the methods and processes to which we have referred or of the many others of equal merit. They are the giants for whose presence the world is the better and they are the first to acknowledge the help that they have received from others. Our object is solely to point out the distorted notion concerning research that seems to exist in the public mind and the fact that it is undoubtedly fostered by falsely romantic accounts in the lay press. This war has shown that we are second to none in the skill to tackle difficult conditions needing the application of science; and while brilliant suggestions have been prolific in aiding us, it is to the team work of a multitude of individuals, most of whom will never receive recognition, that we owe our pre-eminence.

NOTES AND COMMENTS

Fleet Street Blitzkrieg

LOOKING through our files of the period September, 1940, to June, 1941, we were faintly surprised to see how few references there were in the pages of THE CHEMICAL AGE to the somewhat stirring events of the day. Doubtless at the time security reasons precluded more than the most general reference to the effects of the "blitzkrieg" on the activities of London journalism, and no doubt there were many amusing incidents that have since slipped our memory. Our determination to carry on at all costs is duly recorded, and in the first issue of 1941 appears a picture of the home of THE CHEMICAL AGE against a background of fire; but the most significant paragraph, to our mind, was one urging all firms to keep their war diaries up to date, so that, in due time, we might be able to tell the story of the part played by the chemical and allied industries in the Battle for Britain. It will not be forgotten that in those days the people of this country stood alone against the enemies of civilisation.

A Vivid War Diary

THE blitzkrieg is now ancient enough history for some of its events to be published, and our journal has been so fortunate as to find an able recorder of its own vicissitudes in the person of Mr. Gordon Robbins, chairman of Benn Brothers Limited, proprietors of THE CHEMICAL AGE, who did in fact keep his war diary up to date. This diary has now been published under the title *Fleet Street Blitzkrieg Diary* (Ernest Benn; 5s.), and it remains plain and unadorned in diary form, and all the more vivid for that. Nothing has been added; but—and it is a big "but"—Mr. Robbins is a journalist to the core, and his rough notes have all the liveliness of the actual. Reading them, we were transported back to those days of expedient, of improvisation, of determination to get the paper out on time; the myriad difficulties of printing and of transport, the destruction or ruin of familiar landmarks, were brought to mind with all the incisiveness that the pen of a skilled journalist can command. This unvarnished story is a fascinating record of a crisis sturdily surmounted, and is, besides, a good counterblast to the turgid sentimentality of certain other war records. The sufferings of many journals are described; we feel rather proud that the only specific mention of THE CHEMICAL AGE records the fact that its Year Book for 1941 was the first of Benn Brothers' Year Books to turn up—only a month late!

Colonial Geology

LINKS between chemistry and geology are as numerous as they are obvious, and we have accordingly no hesitation in calling the attention of chemists to the valuable article compiled by the Intelligence Staff of the Mineral Resources Department, Imperial Institute, entitled "A Review of Geological Survey Work in the Colonies" (*Bull. Imp. Inst.*, 1943, *41*, 4, 255). One of the main tasks of the Imperial Institute has been to encourage local industries throughout the Colonial Empire, in order to raise the standard of living and purchasing power of the inhabitants, and it is both fair and opportune that attention should be drawn to the wisdom of allocating a share of any available grants for this purpose to the expansion of geological surveying. It is hardly necessary for us here to point out the value of geology to the economic and cultural development of a country.

Surveyors' Troubles

OFFICIAL expenditure on geology has been niggardly in comparison with that on other analogous activities and colonial geological surveys have led a Cinderella-like existence—shoved into the background when retrenchment was in the air. At the same time, we confess we were surprised to hear that three of the largest colonial territories were without any geological survey at all, viz., Northern Rhodesia, Bechuanaland, and Aden Protectorate. Such surveyors as there have been elsewhere have been hampered by several factors: lack of good topographical maps; the need for developing adequate water supplies; and the prior claims of agricultural work. In many cases young men without sufficient training have been sent to do

the work, and one good suggestion of the Institute is the setting up of special training courses for officers for this service The article is modest concerning the work achieved by the preliminary mining surveys carried out by the Institute; these have, in fact, done sterling service in preparing the ground for full surveys, and in locating economic mineral deposits.

Absence from Work

THE conditions that affect industrial health and efficiency have of recent months attracted a great deal of attention. In the last war many facts about this aspect of industry were discovered, and some of them were applied. In the inter-war years there was a tendency to forget those lessons of the war years. This war, with bombing and black-out adding to production difficulties, has made it inevitable that the factors influencing output should be reinvestigated and that the positive findings of thirty years' experience should be applied conscientiously. The new pamphlets issued by the Industrial Health Research Board will greatly assist both employers and workers in this matter. The latest of these, entitled *Absence from Work* (H.M.S.O., 3d.), is an excellent production, well written and attractively illustrated. It is based on the inquiries the Board has made in about 60 factories, varying size from small concerns to those having as many as 25,000 employees. One of the first facts it fastens upon is that whereas absence from work in peacetime averaged 5 per cent. of possible work-hours per year, to-day it is estimated that 6-8 per cent. for men and 10-15 per cent. for women may not be too high. It next describes, in simple direct language, what can be done to reduce absence to the minimum. We hope this document will be widely read and its suggestions put into practice. Incidentally, we should like to hand a bouquet to its authors for not once using the abominable term "absenteeism."

Stockpiles

THE concept of stockpiles—reserves of strategic raw materials—was before the war foreign to both Britain and America. Just how foreign it used to be to us was well illustrated by the Government action after Dunkirk, when the loss of immediate markets for coal led to the disbanding of part of the labour force of the mining industry—a fatal mistake for which we are still paying. Had we kept our miners in the pits instead of putting them in the Army the fuel cuts announced a week ago would scarcely have happened. Judging from recent speeches, articles, and actions, the Americans are fast learning the hard facts that war drives home about raw materials. We recommend to our readers' notice an article by Mr. William L. Batt, vice-chairman of the War Production Board and a member of the Combined Raw Materials Board, in *Foreign Commerce Weekly* (February 26, p. 3). He starts his argument by driving home the point that natural resources will not last for ever; he foresees that America will have to face an eventual shortage of high-grade iron ore, zinc, copper, and bauxite; and he suggests that another war would find her in the plight of Britain in 1940—dependent upon imports to maintain her very existence.

A Retreat from Gold

AMERICAN post-war policy, he suggests, should be to import as much as possible of all the critical materials and to use as little as possible of her own precious remaining supplies. (This was, of course, the policy of Germany and Japan before 1939.) Such a course would, naturally, lead to a sharp reduction in the American emphasis on gold as a means of payment; other countries would exchange raw materials for America's surplus manufactured goods. To prevent the imported raw materials from depressing American prices, it would be necessary to freeze the surpluses over and above normal import needs. Mr. Batt thinks this could be done by retaining these materials in a stockpile, which would not be touched except in a national emergency. Such a policy America may well adopt. Indeed, the oil pipeline which has been the subject of so much controversy is an indication that she may already have adopted it. We wonder whether the British Government is considering a similar scheme, and if so what will be the reaction of our captains of industry and commerce towards it.

Recent Developments in Analytical Chemistry—IX

(From Our Analytical Correspondent)

THE *Annual Reports on Applied Chemistry*,[1] which have appeared since the last article in this series, detail many analytical methods which have been found applicable to fuels, gas and tar products, mineral oils, fibres, pulp and paper, glass, ceramics, fats, plastics, pigments and paints, rubber, soils and fertilisers, sugars and starches, foods, water, and air. It can only be regretted that it was found necessary to omit from the *Annual Reports on the Progress of Chemistry* the section which normally deals with aspects of pure chemical analysis. It must be a matter of some concern to all analytical chemists that their branch can still be regarded as the first that can be jettisoned when circumstances such as the paper shortage call for some lightening of the load on publications. That this is not wholly the attitude, however, is indicated by the gratifying news that, in future, analytical abstracts are to receive special attention from the Bureau of Abstracts. The new series, C, *Analysis and Apparatus*, will for the moment appear quarterly, and started in March. Apart from the usefulness of the move, it is to be hoped that the separate attention may gradually emphasise to the general chemical public that analytical chemistry is a branch with needs, problems, and importance of its own.

Microchemical Articles

Microchemists will note with interest that the Journal *Metallurgia* has started, with a recent issue, the reservation of a four-page section for articles with a specifically microchemical bearing. The first Microchemical Section contained an article on electrographic analysis,[2] which dealt with the nature of the technique, and the apparatus and methods which can be employed to carry it out. A number of cases in which the method has proved successful are instanced. The main article of the second issue surveys the various methods of polarographic technique which have been developed,[3] with special reference to the recording polarograph. This Section can perform a very useful function for microchemists, both in the way of a broad survey and in giving them a focus for their work which is specifically their own. Further welcome news for microchemists is to be found in the announcements that the British Standards Institution has taken up the problem of the standardisation of some of the more vital microchemical apparatus, and has appointed two sub-commitees which are in progress of dealing actively with this.

Qualitative Analytical Reagents

The use of sodium rhodizonate as a reagent for the detection of barium, strontium, and sulphate is already well-known, being dealt with in Feigl's handbook.[4] The reagent has now been further investigated from the point of view of its reactions with a wide range of cations. It has been shown to have considerable use in the detection of lead.[5] Complexes are formed between lead and the reagent, both in neutral solution, and in a solution at *p*H 2.8 by a tartaric-acid/tartrate buffer. These complexes are suitable for indicating the presence of lead in certain cases which would otherwise present a difficult or a tedious problem. For example, by the use of the sodium rhodizonate, it is comparatively easy to detect lead in dilute solution; lead in the presence of ions that otherwise interfere, notably silver, mercurous mercury, and thallium; lead in pigments and glass; and lead in minerals and alloys. These last two cases are dealt with more fully in a further paper.[6] The reaction is sensitive, permitting 0.1 μg. to be detected by a spot test on the neutral solution. In addition, the detection of the more usual metallic ions, barium and strontium, in the precipitate from analytical group V is detailed.[5] Preliminary work suggests that sodium tetrahydroxyquinone may give reactions similar to those of the present reagent, and may therefore be applied in its stead.

The fact that zinc ions are readily adsorbed on magnesium hydroxide, and that the zinc then forms a characteristic compound with benzoin, has been used to provide a sensitive test for zinc.[7] By adding a magnesium salt and alkali to the solution being tested, a green fluorescent product results, in the presence of 10 μg. or more of zinc. The fluorescence is pronounced and specific. If the method of comparing with solutions containing standard amounts of zinc is applied, it is possible to get a semi-quantitative estimate of the amount of zinc present in the unknown, to within 10 μg., where the amount of zinc is not too great.

A strongly alkaline solution of potassium periodate[8] may be used to detect lithium in the presence of the other alkali metals and ammonium. In 1 ml. of the test solution, 0.1 mgm. of lithium may be detected by precipitation, while 0.5 mgm. may be de-

tected in the presence of 50 mgm. sodium, 100 mgm. potassium, or 50 mgm. ammonium. The reagent solution consists of 24 g. of potassium hydroxide and 10 g. of potassium metaperiodate in 100 ml. of water. While the precipitation of the lithium is quantitative, the lithium content of the precipitate is not sufficiently constant to allow the element to be estimated gravimetrically: but conditions have been laid down which are suitable for the volumetric determination of the lithium, by redissolving the precipitate in dilute sulphuric acid, and determining the periodate either by an iodine/thiosulphate, or an iodide/arsenite titration.

The detection of vanadium, particularly in steel, often presents certain difficulties if titanium, molybdenum, or tungsten is present. The normal method of detection, by hydrogen peroxide, gives a positive result in the presence of titanium, unless the titanium is prevented from interfering by addition of fluoride. The other two elements, and large amounts of iron, must be removed before applying the peroxide test. To improve on this test, a reagent has been suggested[9] which is prepared by dissolving 2 g. of benzidine in 100 ml. of 96 per cent. alcohol, adding 100 ml. of water, and then 100 ml. of phosphoric acid. A precipitate of benzidine phosphate first forms, and this is redissolved. With vanadium the reagent solution gives a clear yellow colour which is not given by ferric ion, titanium, molybdate, or tungstate. In 0.3 ml. of test solution, 0.4 μg. of the element is detected. The test is not, however, completely specific, since it is also given by certain ions, in particular, cerium, gold, chromate, and permanganate.

Estimation of Lead and Barium

Two volumetric methods for the estimation of lead have been described. In the first of these[10] diphenylcarbazone has been recommended as an indicator, as being more satisfactory than diphenylcarbazide. A considerable range of salts which give insoluble products with lead solutions may be used for the titration: potassium ferrocyanide, sodium oxalate, disodium phosphate, sodium tungstate, potassium sulphate, and sodium thiosulphate have all proved satisfactory. On the other hand, ammonium fluoride, potassium iodate, potassium selenite, sodium selenate, sodium arsenate, and ammonium molybdate have proved unsuitable for the titration.

In the other volumetric method, which uses chromate solution as titrant, 2,6-dichlorophenol-indophenol is proposed as indicator.[11] On the macro scale an accuracy of less than ± 0.5 per cent. is possible, while on the semi-micro scale it is still possible to achieve an accuracy of ± 1 per cent. If the amount of neutral salts in the solution (such as are produced by neutralisation of an acid solution) becomes greater than 10-20 times the equivalent amount of lead, then the end point is somewhat obscured. Salts which hydrolyse should not be present.

In another paper it is pointed out[12] that, for the gravimetric estimation of lead, precipitation as chromate is to be preferred to precipitation as sulphate, on the grounds of both rapidity and simplicity. As a consequence, the chromate method is chosen for the estimation of lead in the presence of copper, cadmium, or iron. Where copper and cadmium are present, several ml. of 2*N* sodium or ammonium acetate, and 3-5 ml. of 2*N* acetic acid are added to 100 ml. of test solution, which is then treated with 1 per cent. chromate solution to precipitate the lead. The precipitate is washed with 1 per cent. acetic acid, and either dried at 100°C., or subsequently washed with alcohol and ether, and dried for half an hour, where extreme rapidity is desired. For the estimation in the presence of iron a higher concentration of acetic acid—5 ml. acetic acid and 5 ml. of the acetate solution—is required to keep basic ferric acetate from precipitating. Otherwise the procedure is similar.

Ammonium chromate has been used as the basis of a colorimetric estimation of barium.[13] When a standard solution of the reagent is treated with a solution of a barium salt, the barium chromate is precipitated. If a graph of ammonium chromate against transmission of light is prepared, it is then possible, by referring to this, to determine the excess of ammonium chromate remaining in the solution after the precipitation, and hence the amount of barium that has been precipitated. The method is suitable for application to amounts of the order of 1 mgm. of barium, the results being accurate to within 1 per cent.

Calcium Estimation

The determination of calcium as oxalate is subject to certain errors which become magnified on the micro scale. In the more usual method of estimating calcium in serum, errors may arise, among other sources, from the decanting of mother liquor from the precipitate of oxalate after centrifuging, which may result in mechanical loss, or from the decanting of the wash liquor, ammonium oxalate, which in addition may remove small amounts of the precipitate through solution. As a consequence, it is recommended[14] that instead of centrifugal separation a filter-stick procedure should be employed. Such a procedure, as outlined, proves to be more accurate, and capable of dealing with smaller amounts of calcium, than any of the procedures usually adopted.

When calcium must be estimated in the presence of a number of other elements, it

is usually recommended that it be reprecipitated if the oxalate method is employed. It has been shown[15] that this operation can be rendered unnecessary. If the *p*H of the solution is controlled at 3.7 by the use of a formic-acid/formate buffer, and oxalic acid added slowly to the hot solution, followed by rapid cooling, the calcium is precipitated practically quantitatively as oxalate. It is then either dissolved in dilute sulphuric acid and titrated against permanganate, or estimated gravimetrically either as calcium oxalate monohydrate or as calcium carbonate (but not as calcium oxide). In this way an accurate measure of calcium is obtained in the presence of the amounts of aluminium, iron, magnesium, manganese, phosphorus, sodium, and potassium usually occurring in limestones.

Calcium is precipitated as tungstate by the action of sodium tungstate, and this reaction has been employed quantitatively. However, it is shown[16] that the composition of the precipitate varies noticeably with the *p*H of the solution from which it is precipitated. A precipitate of constant composition can be obtained from a solution which is neutral or weakly alkaline with ammonia, by using a 100 per cent. excess of precipitant, and this precipitate, although it is rather heavier than would be expected stoichiometrically, is nevertheless suitable for the determination of calcium. The precipitate should, in order to obtain the best results, be ignited at 800-900° C. The main drawback of the method is that it cannot be applied to the separation of calcium from magnesium, since the calcium tungstate proves to be too soluble.

Plant Tissues

A complete systematic procedure has been worked out for the estimation of twelve elements in plant tissues.[17] For the complete analysis, 7.5 gr. of tissue are necessary, the solution obtained after digestion being split into six fractions. On the first fraction molybdenum is estimated colorimetrically with stannous chloride and potassium thiocyanate; manganese is estimated colorimetrically by periodate; iron is estimated colorimetrically by *o*-phenanthroline; and phosphorus is estimated colorimetrically with ammonium molybdate and 1,2,4-aminonaphthol sulphonic acid. In the second fraction cobalt and copper are both estimated colorimetrically, the former by nitroso-R salt, and the latter by sodium diethyldithiocarbamate. Zinc is estimated colorimetrically by diphenylthiocarbazone, and sulphur gravimetrically as sulphate, using separate fractions for the two estimations. In the fifth fraction calcium is determined volumetrically by titrating permanganate against the oxalate, while magnesium is estimated colorimetrically using phosphomolybdic acid, sodium tungstate, and phosphoric acid applied to the magnesium-8-hydroxyquinolate. The final fraction is used for the estimation of sodium and potassium. Both estimations are colorimetric, the former by zinc uranyl acetate and sulphosalicylic acid, and the latter by sodium cobaltinitrite and dichromate.

Antimony Estimation

For the volumetric estimation of antimony, using potassium bromate, the antimony is first precipitated as sulphide.[18] The precipitate is collected on a Gooch crucible in which the asbestos is protected by a perforated porcelain plate. After drying, the precipitate, or the whole crucible if its size permits, is transferred to a Kjeldahl digestion flask, and dissolved by warming with about 10 ml. of concentrated sulphuric acid. After cooling, a pinch of sodium sulphite is added. The solution is then diluted with 50 ml. of dilute (1 : 5) hydrochloric acid, and boiled to drive off sulphur dioxide. The titration is then carried out with 0.1*N* potassium bromate. It is pointed out that the antimony sulphide precipitate could equally well be collected on paper in the first stage of the procedure, but in this case lengthy digestion is required in order to destroy the paper.

Antimony may be estimated[19] in certain alloys by a dichromate/ferrous-sulphate titration. With tin-base alloys the sample is dissolved in concentrated sulphuric acid, and boiled to remove sulphur dioxide and any sulphuretted hydrogen that may be evolved. Hydrochloric acid and a slight excess, as indicated by the colour, of standard dichromate solution are then added, followed by two or three drops of an indicator solution which is prepared by dissolving the barium salt of diphenylamine sulphonic acid in concentrated sulphuric acid. Phosphoric acid is then added, and the solution back-titrated with ferrous sulphate solution. The end point is finally attained with the dichromate. If the alloys are lead-base, it is advisable to dissolve them in nitric-acid/tartaric-acid, followed by treatment with sulphuric-acid/potassium-sulphate, otherwise the solution process may give trouble.

A reversal of the usual procedure for determining antimony is to be found in a method which employs titanous sulphate as titrant.[20] Oxidation to the quinquevalent state is first carried out, using bromine, and the titanous sulphate is used to bring it back to the trivalent state. The titration must be carried out hot, and in the absence of air. While various oxidation-reduction indicators have proved successful for the purpose of determining the end point of this titration, those recommended are indigo

carmine, neutral red, safranine, or brilliant cresyl blue.

Elementary Organic Analysis

Several years ago a method was devised to take the place of the conventional Liebig method for the ultimate analysis of coal.[21] The classical method requires the combustion, in an elaborately packed tube, of the material with a slow stream of oxygen, and is familiar to all analysts both in its Liebig (macro) and Pregl (micro) forms for the elementary analysis of organic compounds. The newer method, as applied to coals, consists in burning the sample in a rapid stream of oxygen at a high temperature, using a tube containing neither catalyst nor any of the complicated packing formerly considered necessary. Water resulting from the combustion is absorbed in magnesium perchlorate (anhydrone), carbon dioxide in soda-asbestos, while sulphur dioxide and chlorine are taken up by a spiral of silver gauze. The method has now been adapted[22] to deal with organic compounds on the micro-scale, as an alternative to the Pregl or similar methods. The combustion tube is maintained at 800°C. by means of an electric furnace, and oxygen is passed at a rate of 50 ml. per minute. Under these conditions, a complete combustion is carried out in 10 minutes. Carbon and hydrogen are estimated in the normal fashion, sulphur is taken up on the silver gauze, and may be removed from this and estimated, so that the three elements may be determined in a single combustion. Although halogen is also taken up by the gauze completely, and so is prevented from interfering, it is not recommended that the resulting silver halide should be used as a means of estimating the halogen present, since the results tend to be low. More satisfactory results are obtained by absorbing the halogen and estimating it titrimetrically, carrying out a separate combustion for the purpose.

It is claimed that certain of the precautions recommended by Pregl in the carrying out of carbon-hydrogen micro-estimations are unnecessary, and may be omitted with advantage, thus making the determinations simpler for beginners, and shorter in time.[23] The simplification is achieved primarily by the use of an extra absorption tube, both as a control and as a tare. In the first instance, the elaborate wiping procedure recommended by Pregl, with moist and dry cloths, may be omitted, the only wiping being at the outside of the tips, with gloved fingers, and inside the tips with a pipe-cleaner. As a consequence, the tubes, it is claimed, reach constant weight within two or three minutes of being placed on the balance, instead of necessitating the considerably longer time interval normally allowed. The weight which the tubes reach in this short period remains constant for at least an hour, so that it is not so necessary to adhere to a precise time-table in weighing. It is obvious that after several determinations the absorption tube used for the determination will be considerably heavier than the tare, owing to the absorption of several hundred mgm. of gas or vapour. This may be adjusted by weights added to the tare, without altering the accuracy of the method noticeably. It is stressed that a pair of clean white cotton gloves should always be worn while handling the absorption tubes.

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PROTECTING PIPES BY ZINC ANODES

At the request of the water department of Wichita Falls, Texas, and with with the co-operation of the Cast Iron Pipe Research Association, K. H. Logan, chief of the underground corrosion section of the U.S. National Bureau of Standards, is making a special survey of corrosion experienced in the vicinity of that city. The shortage of iron and steel has accentuated the need for reducing corrosion of pipe lines as much as possible. The most promising method at present seems to be the imposition of negative electrical potentials on a line which is to be protected. There are two ways of doing this, one by drawing energy from a regular power line, the other by connecting to the pipe line zinc slabs buried at intervals in the earth. The first method is in widespread use in Texas, and a very extensive installation of zinc anodes has been in use in southern Colorado for a number of years.—*J. Franklin Inst.*, Jan., 1944, p. 49.

Production of Chromium Compounds

New Four-Stage Process

IN the preparation of chromium compounds from crude materials such as chromite ore, the processes usually employed consist in subjecting chromite ores to oxidising or roasting treatments in the presence of one or more alkali compounds, such as sodium carbonate, hydroxide, or sulphate, the operation being conducted under such conditions as to oxidise the trivalent chromium of the chromite ore to the hexavalent state, and to produce alkali metal chromates. Further processing to produce other chromium compounds (such as chromic oxide, calcium chromite, and calcium chromate) is usually carried out independently, and, in consequence, the sodium oxide content of the chromate compound is wasted or is not recovered in a form readily available for re-use in the chromate production operations.

In the present invention (B.P. 558,986; to M. J. Udy) means are provided for the production of chromium compounds under conditions such that the alkali metal oxide content of chromates employed in their production is utilised for the production of additional chromate. The processes are conducted in the following stages.

The Four Stages

(1) Chromite ore is oxidised or roasted in air in the presence of one or more alkali metal compounds in accordance with usual practice.

(2) The chromate is separated from other materials associated with it in the oxidised or roasted charge, by leaching with an aqueous liquid followed by evaporation and crystallisation.

(3) Reduction of the chromate then proceeds directly, or after conversion to dichromate, with the production of chromic oxide as such or chromic oxide chemically combined with a basic oxide and one or more alkali metal compounds suitable for the treatment of chromite ore.

(4) Utilisation of the alkali metal compounds thus produced in an oxidising or roasting treatment of additional chromite ore.

It is claimed that the invention provides more efficient and less expensive processes for utilising commercial alkali metal chromates and dichromates in the production of compounds such as chromic oxide, calcium chromite, and calcium chromate. An alkali metal chromate or bichromate in finely-divided form is intimately mixed with finely divided solid carbonaceous reducing material and ignited. For the production of pure compounds, finely-divided charcoal is preferably employed. The reduction proceeds somewhat as follows:

(1) $Na_2Cr_2O_7 + 3C \rightarrow Na_2O.Cr_2O_3 + 3CO$

(2) $2Na_2Cr_2O_7 + 3C \rightarrow 2(Na_2O.Cr_2O_3) + 3CO_2$

(3) $2Na_2CrO_4 + 2C \rightarrow Na_2O.Cr_2O_3 + Na_2CO_3 + CO$

(4) $4Na_2CrO_4 + 3C \rightarrow 2(Na_2O.Cr_2O_3) + 2Na_2CO_3 + CO_2$

Digestion of the solid reaction products resulting from the reduction with carbon provides a solution of sodium hydroxide substantially free from sodium carbonate in the case of the reduction of sodium dichromate, and a solution of sodium hydroxide and sodium carbonate in the case of the reduction of sodium chromate, and in both cases hydrolysis results in the formation of a solid residue consisting essentially of chromic hydroxide: $Cr(OH)_3$.

Calcium chromite may be formed by igniting an intimate mixture of finely-divided sodium chromate or sodium dichromate, finely-divided calcium oxide, and finely-divided carbon, the reactions proceeding somewhat as under:

(5) $Na_2Cr_2O_7 + 2CaO + 2C \rightarrow (CaO)_2Cr_2O_3 + Na_2CO_3 + CO$

(6) $2Na_2Cr_2O_7 + 4CaO + 3C \rightarrow 2(CaO)_2Cr_2O_3 + 2Na_2CO_3 + CO_2$

(7) $2Na_2CrO_4 + 2CaO + 3C \rightarrow (CaO)_2Cr_2O_3 + 2Na_2CO_3 + CO.$

The sodium carbonate and calcium chromite thus produced may be separated by digesting the solid reaction products with water. Calcium oxide may be employed as such or as the carbonate. Equations 5 and 7 indicate the production of a compound approximating in chemical composition to dicalcium chromite. Similar mono-calcium or tri-calcium compounds may be produced by adjusting the proportions of chromate or dichromate and calcium oxide employed. The reactions 1 to 6 are exothermic and proceed to completion without the application of heat from extraneous sources.

REMOVING CARBON DEPOSITS

A note in *Chemical Industries* (December, 1943) describes a novel method of cleaning flasks and other vessels that have become blackened by deposited carbon. The technique is as follows:

Put enough potassium chlorate into the dried flask, from which as much carbon as possible has been removed by mechanical means. Heat just enough to melt the potassium chlorate and slowly rotate the flask so that the molten material flows over all the carbon. The reaction is instantaneous; after cooling, the residue dissolves out in water.

Phthalocyanine Pigments

Economical Manufacture

IN the production of copper phthalocyanine pigments from *o*-dinitriles, many technical difficulties are encountered; the reaction is highly exothermic and difficulties are encountered when no solvent or diluent is used. When copper halides are used with a diluent, only a portion of the copper is utilised in actually forming a halogen-free pigment, part of it being employed to react with halogen set free. In the known standard method for producing copper phthalocyanines, by a reaction of phthalonitrile and cuprous chloride at temperatures under 180° C., the reaction proceeds as follows:

$$4C_6H_4(CN)_2 + 2CuCl = C_{32}H_{16}N_8Cu + CuCl_2.$$

In this reaction, 100 per cent. excess of cuprous chloride is used over that necessary to supply the amount of copper actually entering into the pigment molecule. The second molecule of cuprous chloride performs the function of a chlorine acceptor. At higher temperatures the cupric chloride formed also reacts and in this case the pigment itself acts as the chlorine acceptor and chlorinated pigments are produced. Technically, it has not been possible to produce an unchlorinated pigment, using cupric chloride as the only cupriferous agent.

No Waste of Copper

According to a process (B.P. 559,247), patented by H. G. Cruikshank Fairweather and the American Cyanamid Company, it has been found that aromatic *o*-dinitriles, in a suitable diluent or solvent such as nitrobenzene, can be reacted with cupric compounds, such as cupric chloride, cupric bromide, or cupric sulphate, provided that an excess of ammonia is present in the reaction zone. The pigments are unhalogenated when the cupric halides are used, contrary to the results normally obtained. It is claimed that excellent yields are obtained, and there is no waste of copper such as is necessitated with the cuprous halide process formerly used.

The aromatic *o*-dinitrile is reacted in the substantial absence of water with a cupric salt, in the presence of a practically inert organic diluent liquid, at reaction temperature and in the presence of an amount of ammonia at least sufficient to combine with all of the anion of the cupric salt set free in the reaction to produce the corresponding ammonium salt of the anion and hydrogen. It is important to keep any considerable amount of water out of the reaction mixture, but traces will not cause serious harm. There is evidence that the ammonia acts primarily as an anion acceptor, a portion of the ammonia being oxidised by the anion—such as the sulphate or halogen anion—to nitrogen, and the remainder of the ammonia reacting with the acid thus formed to produce the ammonium salt of this. In the case of cupric sulphate, the reaction may be considered to proceed as follows:

$$12C_6H_4(CN)_2 + 3CuSO_4 + 8NH_3 \rightarrow 3C_{32}H_{16}N_8Cu + 3(NH_4)_2SO_4 + N_2.$$

In the past it has been proposed to produce metal-free phthalocyanine pigments by heating an *o*-dinitrile in the presence of ammonia, but in the absence of any copper compound. The ammonia in this case, however, does not perform the function of a combined reducing agent and anionic acceptor as is the case in the present invention, where a cupric salt is also present in the reaction product. The aromatic *o*-dinitriles used may be carbocyclic or heterocyclic. Best results are obtained at temperatures of 180-200° C.

Chlorine Dioxide Production

Use of Hydrogen Peroxide

THE usual process for the production of chlorine dioxide involves the acidification of a chlorate, which has the disadvantage that the production of the dioxide is accompanied by the simultaneous production of either chlorine or perchlorates. It has been found that, by using oxalic acid as a reducing agent, chlorine dioxide substantially free from chlorine can be produced, but the chemical efficiency of the chlorate conversion remains low, approximating to something like one-third to one-half of the chlorate supplied to the reaction.

In a new process (B.P. 558,960), assigned to Mathieson Alkali Works, New York, by E. C. Soule, it is proposed to react a metal chlorate with a mineral acid strong enough to liberate chloric acid from chlorates, with a *p*H not substantially exceeding 1, in the presence of hydrogen peroxide at a temperature of about 70° C. The proportion of hydrogen peroxide used is not critical with respect to the production of chlorine dioxide free from chlorine. For high efficiency with respect to chlorate conversion, the proportion of hydrogen peroxide should be approximately equivalent to that of the chlorate, *i.e.*, one mol. of hydrogen peroxide per 2 mols. of chlorate ion. The peroxide acts apparently as a selective reducing agent to form chlorine dioxide, without the formation of chlorine or perchlorates. The specific reducing power of hydrogen peroxide in this reaction can be represented as:

$$2HClO_3 + H_2O_2 \rightarrow 2ClO_2 + O + 2H_2O.$$

In any event, the reaction can be carried on with nearly 100 per cent. thermal efficiency. If water is permitted to accumulate in the reaction mixture, through reduction or through addition with the reactants, the efficiency of the conversion tends to decrease.

Chemistry and Beet Sugar

Some Industrial Applications

AN extremely interesting lecture delivered recently to the Irish Chemical Association by Dr. T. Twomey, of the Irish Sugar Company, brings into prominence the importance of scientific research in this comparatively new industry, and at the same time chides many of those actually concerned in the industry for their indifferent attitude towards its development. Though Dr. Twomey's remarks were addressed primarily to the Irish branch of the industry, beet-sugar production in England is by no means conducted in so impeccable a manner as to detract in any way from the value of his words to our own chemists and industrialists.

Research Organisation

The technical organisation of a sugar factory, said Dr. Twomey, varies considerably in different countries, and even between factories. At one end of the scale are the highly organised sugar-producing countries like Russia, Germany, and Czechoslovakia, each possessing over 100 factories. These countries have found by experience that, rather than allow scientific development to be a haphazard affair, to be attended to at the discretion of the individual factory mangers, it was better to have a central research station financed by the various factories and staffed by chemists, physicists, botanists, and engineers. This central laboratory is the scientific hub of the whole sugar industry in the country. It conducts independent research work on all matters affecting the production of sugar, and the results of its investigations are at the disposal of industry as a whole. It must not be thought that this centralisation of research kills all individual effort or initiative in the factories. On the contrary, the various factory staffs are encouraged to investigate problems for themselves, and the large volume of published work bears testimony to their efforts.

Poland, France and Italy followed the Russian and German pattern. In recent years Japan has extended her sugar industry considerably and has established a research station which serves all her food industries.

Countries with a small production of sugar do very little research work. The explanation usually met with is that the cost would be too great, but that is really no excuse. A beet-sugar factory is unique among factories in having a long off-season period after the manufacturing season. During this off-season there is plenty of time for investigating problems and devising new methods, and the cost of providing the necessary equipment need not be very high. Too many managers are content to let the bigger concerns do the work while they merely apply what they read in the literature. This parasitical attitude is to be deplored. It is the duty of all industrial concerns to contribute something to the existing sum of knowledge, apart altogether from the material value which such knowledge may have.

Lime Treatment of Juice

Lime milk has been found the most effective agent for precipitating non-sugars from raw beet juice. The addition used to take place in one operation, but in recent times it has been found that colloid removal was most complete when the lime was added in two stages, *i.e.*, pre-defecation and main liming. Two main schools of thought exist as to the method of pre-defecation. According to the first, raw juice at a temperature of 40° C. is treated with small doses of lime, *gradually* increasing the alkalinity to a maximum of 0.3 per cent. During the addition of lime, punctuated by a series of pauses, a *p*H equivalent to the iso-electric point of every colloid present is reached, and thus all colloids should be coagulated. A further pause is made at the end of preliming, after which the juice is heated in the usual manner and sent to main liming for the final clarification.

The second method is based on the assumption that one or two colloids predominate in beet juice and that there is no necessity for passing through all possible iso-electric point ranges. It is stated that a *p*H of 10.9 gives the most complete coagulation of colloids and that the correct procedure is to add enough lime in pre-defecation to reach that point, to hold it there for about 10 minutes and then proceed with main liming. Both methods of operation are found in practice.

Carbonatation

The excess lime in the limed juice has to be removed and this is done by means of CO_2 gas, by the process called carbonatation. In order to avoid re-solution of the precipitated non-sugars it is done in two stages. Carbon dioxide is added until the alkalinity of the juice falls to about *p*H 10.9, after which it is filtered and the gassing then continued in the filtrate. Formerly, the second gassing was continued until the alkalinity of the juice fell to 0.015 per cent. CaO, this much being retained as a safeguard against inversion. The modern view of second carbonatation is that its purpose is to remove dissolved calcium salts by interaction between them and sodium carbonate, after all

calcium oxide has been removed. Sodium is normally present in beet juices in sufficient amount for the reaction, but occasionally it is necessary to increase it by the addition of soda. The main objection to the retention of calcium alkalinity in juices is that it leads to heavy incrustation on heating pipes during subsequent evaporation and this results in reduced heat transfer and increased fuel costs.

Removal of Incrustation

Despite every precaution, it is not possible completely to avoid the formation of scale on heating surfaces, and sometimes this reaches such proportions that a shutdown becomes necessary. Some factories "boil out" their evaporators once a week as a precautionary measure, and such stoppages are both costly and troublesome. Scale consists for the most part of calcium carbonate, sulphite, phosphate, silicate, and oxalate, and the usual treatment is to boil first with dilute hydrochloric acid to remove the first three constituents, followed by 8 per cent. caustic soda to dissolve the silicates and oxalates. The practice which persists in some factories of trying to remove scale by covering the affected plant with dilute molasses is unscientific and ineffective. Manhandling with suitable scrapers is the means most generally used for descaling pipes, but a satisfactory chemical method would be welcomed.

Purification by Ion-Exchange

Many new synthetic ion-exchange adsorbents of high exchange capacity have lately appeared on the market, and their possible application in purifying sugar liquors has attracted attention. A complete trial has been conducted in an American factory, and astounding removal of non-sugars is reported. A juice having a purity of 90 per cent. was passed in succession through beds of cation and anion exchangers; the resulting liquor had a purity of 99 per cent., compared with 93-94 per cent. obtained by the conventional lime treatment. This naturally means a big increase in final sugar yield, and a corresponding reduction in the quantity of molasses formed. In addition, fuel and equipment costs would be much smaller and several stages of the existing process could be eliminated.

Control of Boiling

Pan-boiling, or sugar "cooking" as it is sometimes miscalled, became an art before becoming a science and, as with most industrial "arts," it is an uphill fight trying to bring scientific principles to bear. It is conducted by trained operatives who but dimly understand the fundamentals involved, and the modern tendency is to reduce the human element to a minimum. Control instruments have been devised to connect the viscosity of the boiling mass with its supersaturation. Others are based on a consideration of the electrical conductivity of sugar solution as a measure of their supersaturation. The main objection to these is that the particular spot within the pan at which the viscosity or conductivity measurements are taken is not representative of the mass as a whole, owing to the poor circulation. The most recent development arose from the discovery that at all pressures encountered in usual sugar-boiling practice, a graph of the boiling-points of sugar solutions of any degree of supersaturation, against the corresponding boiling-points of water at the same absolute pressure, was a straight line. A formula has been developed from this, and an instrument constructed which records the degree of supersaturation continuously. A claim has been made in Russia for a method which makes pan-boiling entirely independent of the human element. The whole process is done by instruments and one man sitting at a control panel is alleged to be able to boil several pans simultaneously. No details are given of the equipment.

By-Products

Most of the molasses goes to form the stock feed known as molassed pulp. Some finds an outlet in the manufacture of yeast and ethyl alcohol. An American biochemist has urged that molasses might be made the basis of a series of biochemical industries producing such bodies as glycerine, alcohol, and acetone, and acetic, citric, and lactic acids. One of the most interesting of these processes is in the production of the new motor fuel called Jeanite. This is obtained by the polymerisation of ethyl and butyl alcohols, both of which may be produced from molasses, and tests have shown it to be as good as petrol. It may be manufactured at a competitive price and it holds out great possibilities, particularly for the big cane-sugar producing countries where the molasses surplus is enormous.

PLASTICS GROUP OFFICERS

The following have been appointed officers of the Plastics Group of the S.C.I. for 1944-45:—*Chairman*, Mr. A. J. Gibson (in succession to Mr. E. G. Couzens); *Vice-chairman*, Mr. N. J. L. Megson; *Hon. Treasurer*, Mr. Austin Lowe; *Hon. Recorder*, Mr. J. Irdis Jones; *Hon. Hospitality Officer*, Mr. E. Langwell; *Hon. Secretary*, Dr. S. E. Bell. Mr. C. Diamond, Mr. Austin Lowe, Mr. H. V. Potter and Mr. W. G. Wearmouth retire from the Group's committee, to which Dr. J. E. Sisson and Mr. Foster Sproxton have been appointed. The other two vacancies will be filled by election at the annual meeting.

Nickel Peroxide

An Electrochemical Synthesis

NICKEL peroxide has technical importance as a constituent of the alkaline storage battery and as an essential addition to nickel refining baths; the crude electrolyte contains ions of divalent iron and divalent cobalt which have to be eliminated; their precipitation is achieved by a nickel peroxide. This compound is usually made by oxidising nickel hydroxide with sodium hypochlorite: in a recent Russian paper* its electrochemical synthesis is described. Two methods have been tried. In one of them (I) green nickel hydroxide was prepared first and then electrolysed in a separate operation; in the other (II) a black nickel peroxide was produced directly from metallic nickel.

(I) For preparing nickel hydroxide a NaCl solution was electrolysed with a nickel cathode; the current efficiency was near 100 per cent. at every current density, but the energy consumption decreased together with the strength of the current; 0.1 amp./sq. cm. is the recommended current density. A suspension of this hydroxide containing about 20 g. of nickel per litre was electrolysed between two graphite electrodes; the composition of the liquid, the temperature, the duration, and the electric characteristics were varied, and the efficiency of the process was determined. It was found that high concentrations of NaCl and low concentrations of NaOH were favourable, and suspensions of $Ni(OH)_2$ in 5*N* NaCl + 0.025*N* NaOH were used for further experiments. It was found that the lower the temperature, the higher was the ratio O : Ni in the product, *i.e.*, the higher its activity; the temperature of 20° C. is advised. The ratio O : Ni increases with the duration of electrolysis, but, since the current yield decreases at the same time, it is not economical to extend the electrolysis beyond 1 hour. Current density of 0.075 amp./sq. cm. at the cathode, and of 0.1-1 amp./sq. cm. at the anode, give the best results. Under the most favourable conditions the peroxide contains 1.71 oxygen atoms per nickel atom (*i.e.*, 0.71 atom of active oxygen per molecule of NiO), and its preparation consumes 20 kWh. per kg. of active oxygen.

When, as so far usual, nickel hydroxide is oxidised with NaOCl, the chain from NaCl and $Ni(OH)_2$ to nickel peroxide includes: (a) electrolytic liberation of chlorine; (b) dissolution of chlorine in caustic soda; and (c) the reaction $2\ Ni(OH)_2 + NaOCl + H_2O = 2\ Ni(OH)_3 + NaCl$. If the relative yields of these reactions are multiplied, it is found that a molecule of active oxygen is produced at the expense of about 34 kWh. per kg., so that the electrolytic preparation appears to be more economical.

(II) In a second set of experiments it was attempted to reach nickel peroxide, starting from nickel and sodium chloride, in one step. A nickel cathode was placed between a nickel anode and a graphite anode; the currents passing through each anode could be varied and measured separately. The electrolyte was 5*N* NaCl. At the nickel anode nickel hydroxide formed, and it was oxidised at the insoluble anode. However, the concentration of nickel hydroxide near the graphite anode was so low that the hypochlorite produced there was largely decomposed before coming in contact with the hydroxide, and the current yield and watt efficiency were low.

* N. P. FEDOT'EV and V. V. SVECHNIKOVA, *J. Prikladnoi Khimii*, 1942 *15*, 105.

Liquid Fuel from Wood

The Tetralin Process

TO the three well-known processes for transforming solid into liquid fuel (*i.e.*, distillation, hydrogenation, and synthesis from water gas) a fourth method has recently been added, based on the dissolution of coal in tetralin or phenol at high temperature and pressure. Now the method has been applied to wood, peat, and similar substances (DIAKOVA and MELENTIEVA, *Russ. J. Appl. Chem.*, 1942, *15*, 173, 237).

Sawdust, commercial lignin, cellulose (in the form of filter paper), lycopodium dust, rosin, peat, lignite, brown coal, boghead, oil shale, and asphaltite have been heated in an autoclave with 3 parts of tetralin at 400° C. for 30 min. A considerable proportion of the tetralin suffered dehydrogenation to naphthalene. The organic part (*i.e.*, everything except ash) of the lycopodium, rosin, and asphaltite went into solution or was decomposed nearly quantitatively, a larger percentage of the oil shale and lignite was left undissolved, and even more (roughly 15 per cent.) of the sawdust, lignin, cellulose, and a young brown coal, whereas the peat, old brown coal and boghead left 20 per cent. or more of an insoluble residue (excluding ash). One of the reaction products, being water, had no value; its amount from oil shale, boghead, rosin, and lycopodium was very small, but it reached 24 per cent. with sawdust, and 28 per cent. with cellulose. There was much gas formation, but in the case of lignin alone did the gas contain over 50 per cent. of hydrocarbons. Otherwise it was mainly carbon monoxide and dioxide.

The most valuable part of the reaction

product was that dissolved in tetralin. It amounted to 40-50 per cent. of the total organic matter of sawdust, cellulose, peat, and a brown coal, but was higher for the other materials. This part was divided into a volatile (boiling below 200°) and a "non-volatile" fraction, and the amounts of the fractions were nearly equal for sawdust and cellulose, whereas all the other materials gave mainly "non-volatile" matter. The "non-volatile" fractions were dark viscous oils or low-melting solids containing less oxygen and more carbon (80-85 per cent.) than the original materials. The total amount of the product soluble in tetralin and, therefore, utilisable as a liquid fuel, was found to be much larger than the amount of liquid obtainable by distilling peat, oil shale, etc.

Manufacture of Copper Powder

Use of Scrap Brass Anodes

CONVENIENT manufacture of copper powder in a relatively pure form, from scrap brass and the like, is embodied in B.P. 558,722 (F. W. Berk & Co., Ltd., and Ernst Mehl). The copper powder is electro-deposited cathodically from an acid-reacting chloride electrolyte, using a brass anode. Suitable materials, giving an inert cathode not attacked by the electrolyte, include brass, lead, copper, or stainless steel. The electrolyte should contain at least 2 per cent. free hydrochloric acid and the brass employed for the anodes should contain at least 25 per cent. zinc. Sodium chloride and/or zinc chloride may be added to the electrolyte to facilitate the anodic dissolution of the copper in the brass and to increase the conductivity of the electrolyte.

The brass anode may be in the form of brass scrap or skimmings supported on a graphite plate, basket, or the like, connected to the positive pole, or the scrap or skimmings may be supported on a copper or brass basket or plate. It will be understood, however, that the anode may take other forms such as brass rods The current density employed for the electrolysis is preferably between 1 and 20 amps./dm² and a voltage of from 0.1 to 2 volts is desirable. The temperature should be between room temperature and 100°C., the lower temperature giving spongy deposits, while temperatures of from 70° to 100°C. give more granular and better adherent deposits.

It is considered that the zinc reduces the copper in the electrolyte and retains it in the cuprous form, which is dissolved by the electrolyte. The greater the concentration of cuprous chloride in the electrolyte, the denser will be the powder produced and the greater its adherence to the cathode. The powder obtained consists largely of dendritic particles of relatively low apparent density, while zinc chloride is obtained as a valuable by-product. Specification No. 264,116 is referred to.

Applied Photography

The Kodak Data Book

A NUMBER of revised and new data sheets for this book have been issued. Sheet D 4, dealing with *Photomicrography in Metallurgy* has been expanded to about twice its original length, and the question of illumination for this type of work has received extended treatment. Discussion of the same factor in Sheet D 5, *The Photography of the Macrostructure of Metals*, has caused a similar extension in this sheet. Sheet A 18, *High Speed Photography*, has been completely rewritten, and now covers eight pages as against the original four. The fourth revise, D 2, *Marking out Templates by Photography*, has also been rewritten, and is nearly doubled in length. New sheets have been issued to cover *The Kodatron Speedlamp* (Y 31, 8 pp.) and *The Eastman High-Speed Camera, Type III* (Y 32, 5 pp.). These describe the technique and results in high-speed photographic research, as applied both to transient phenomena and where cinematographic records are required. Sheet A 35 (4 pp.), *Photomicrography with a Hand Camera*, describes a set-up for taking photomicrographs where there is no justification for the purchase of special expensive equipment. *The Vibration Insulation of Photographic Equipment* (A 36, 7 pp.) describes how the correct sort of damping devices to cut out continuous vibrations may be designed and constructed. Insulation against transient shocks, a much more difficult problem, also receives mention. Sheet D 10 (2 pp.), *Micro Motion Study*, describes the technique of recording the details of motion which are used in the performance of any operation, as a preliminary to scientific improvement in efficiency. Finally, a 12-page booklet, *British Standard Photographic Exposure Tables*, gives a selection of the exposure tables from B.S. 935-1941. These tables enable the corrections for time of day and time of year, latitude, weather conditions, etc., to be determined and properly applied to Kodak materials.

SAFETY FIRST

Owing to the vagaries of the postal service, due to the Easter holiday arrangements and other reasons, Mr. Creevey's monthly "Safety" article did not reach us in time for press. It will appear in a later issue this month.

A CHEMIST'S BOOKSHELF

SYSTEMATIC QUALITATIVE ORGANIC ANALYSIS. By H. Middleton. Pp. 280. London: Arnold. 8s. 6d.

Qualitative organic analysis has never achieved the systematisation of qualitative inorganic analysis, and in our student days we often wondered why. To be sure there are difficulties, but it seemed to our slightly-instructed mind that there should be the possibility of distinguishing whole groups of compounds by generic tests followed by specific identification of individuals by their physical properties. Mr. Middleton has set out to achieve the objective for which we then sighed. He has personally examined the behaviour of over 600 substances and many of their metallic derivatives, and from that has built up, under the conditions which he found to be necessary, schemes of systematic analysis. The result is extraordinarily interesting. We should regard this work as in its preliminary stages and we should expect Mr. Middleton to pursue it farther because at present it is primarily for students, since "certain classes of compounds have been omitted, as it is considered unlikely that students will encounter them." The elements are first ascertained (the author here uses his alkali-sugar fusion test, in preference to the more usual sodium fusion tests, combined with his alkali-zinc test for nitrogen). Next physical properties are determined. Five "schemes" are then suggested, based on what elements are present. One imagines that a student who had had the opportunity to work through the many hundreds of individual tests given in this book should secure such a knowledge of organic reactions and their indications as to be able to identify the majority of the commonly occurring substances with ease. This is a book that can be completely recommended to students, and one that should be more than useful to the works chemist.

DICTIONARY OF ORGANIC COMPOUNDS. Vols. II and III, with Supplements. Edited by I. M. Heilbron and H. M. Bunbury. London: Eyre and Spottiswoode. 6 guineas a volume, or 15 guineas for the set of three.

A revised and enlarged edition of Vol. I of this great work appeared last year. It was then stated that Vols. II and III would be reprinted without revision but with the addition of supplements to bring them up to date. This has now been done, though how the compilers of the dictionary found the time during war is a marvel. In this review it is the supplements that command attention. Since the last volume was printed the rank of contributors called "assistant authors" (one is either an author, or not an author—no half-way stage is possible) has been abolished, and this obeisance to the strict meaning of words becomes the authors of a dictionary. The supplement to Vol. II runs to 42 pages, that of its companion volume to 32. We note that two errata in the former have been corrected. In a work of this size errors must be very hard to avoid. With due humility, therefore, the reviewer points out that in Vol. III there appears an entry that reads "*Salvianin* chloride, *see* Monardaein chloride"; under the latter the synonym is again spelt "*Salvianin*", but on looking up "Pelargonin chloride" one finds the word spelt "*Salvinin*"—without a second "a." From its derivation one would expect "Salvinin" to be the correct spelling, though doubtless the published literature about this compound is confusing. (Incidentally, one cannot escape the thought that since pelargonia, monardin, and salvinin are chemically identical it might be best to have one major entry under, say, pelargonin, to which readers would be referred on looking up the other two compounds. Under the present system of indexing the authors are in the anomalous position of having to record under "Monardin chloride "that *monardin* breaks down on hydrolysis to *pelargonidin* and glucose). Every effort seems to have been made to bring the volumes up to date. For instance, the appropriate supplement contains many useful details and references for the newer sulphonamides. The dictionary as a rule does not give trade names. An exception is made in the case of M. & B. 693, though this practice has not been extended to other drugs of the same series; this may seem illogical, but is probably sound, particularly in view of the paper shortage. We note also that penicillin is not listed, though penicillic acid is. The significance of this omission escapes this reviewer, but it must be due either to the lack of an empirical formula (the rule appears to be that all chemicals in the dictionary must have established formulæ), or to the reluctance of the censors to approve its publication. One would like to know the real reason, for in years to come students may consult "Heilbron and Bunbury" (these names are bound to become as much household words as "Thorpe" is) and come to the erroneous conclusion that penicillin had not been discovered by 1943. It is impossible to praise sufficiently the painstaking, careful, and tedious work that must have gone into the compilation of this dictionary. Its value cannot be exaggerated, and doubtless those who can afford the money (its price is high, but certainly not out of proportion to the sheer hard labour which the authors put into it) will not remain for long without it. It will save many busy people a great deal of time and trouble.

JOURNAL OF THE ELECTRODEPOSITORS' TECHNICAL SOCIETY. Vol. XVIII, 1942-43. Published by the Society. Pp. 149. Price to non-members, 21s.

These proceedings of the Electrodepositors' Technical Society include nine papers (the title of one paper, "Determination of Thickness of Deposits by Specific Gravity," by L. S. Larkin, seems to have been omitted from the list of contents), and also reports of discussions that took place in connection with three of those papers, and one from the preceding volume of the journal. The lecture by Dr. S. Wernick, the society's indefatigable secretary, forms an admirable "first chapter" to the book since it deals broadly and interestingly with the trend of electroplating since 1939, concluding with some speculation as to possible post-war developments. Techniques that are being utilised in war industry figure prominently, as for instance in the paper and discussion about the anodising of aluminium and the contribution on chromium plating in ordnance manufacture. This reviewer is always pleased to see an effort being made to record the scientific and technical history of this war, so far as censorship and official secrets allow. In the last war such records were most inadequately kept. If other scientific societies gave as much attention to this problem as the Electrodepositors there would be little cause to fear a repetition.

QUANTITATIVE CHEMICAL ANALYSIS: A STUDENT'S HANDBOOK. By Joseph Reilly and Eileen A. Moynihan. Cork University Press. Pp. 116. 7s. 6d.

This book covers the second-year course in volumetric and gravimetric analysis of University College, Cork, and is fully up to standard; there is a lack of good text-books introducing quantitative inorganic analysis satisfactorily to students. At the same time, the reviewer feels that in the endeavour to cover the field fully, the present authors have failed to achieve adequate clarity and attention to detail. A number of points are not above criticism: two chosen at random may be cited. It is not made clear, and this is a serious omission, that with adsorption indicators it is the precipitate that changes colour; and that hence it is necessary to carry out a silver-halide titration rapidly. Again, in describing the bismuthate method for manganese in steel, one of the industrial analyses included in the course, the use of the term "alloy" would seem to suggest that the steel may contain chromium (a steel chemist would assume that this was implied). But the procedure outlined would not be satisfactory if chromium were present. Yet it is nowhere suggested that any form of interference might occur.

The book includes as an appendix an improved method for the elimination of phosphate in *qualitative* analysis by the use of zirconium oxychloride. While it is stated that this is given as a revision exercise for second-year students, in preparation for the quantitative course, it seems rather incongruous in a course otherwise exclusively quantitative.

The volume is, for war-time, noticeably well produced, being printed on good paper and strongly bound.

Personal Notes

MR. W. T. BRANSCOMBE and MR. E. A. DOWLER have been appointed directors of Pinchin, Johnson & Co., Ltd.

MR. P. J. GRATWICK, managing director of Courtaulds, Ltd., has been appointed also a deputy-chairman of the company. He is also a director of the Central Rayon Office and of Morton Sundour Fabrics, Ltd.

The Colwyn Gold Medal of the Institution of the Rubber Industry has been awarded to MR. A. HEALEY, B.Sc., F.I.R.I., for conspicuous services in connection with the technique of tyre manufacture, with special reference to the problems arising from the use of synthetic rubbers.

The George Medal and the B.E.M. respectively have been awarded to a foreman and a senior overlooker for their bravery in dealing with a fire that had started in a Royal Ordnance Factory. MR. HARRY HUDSON, who receives the G.M., and MR. ROWELL HALL were on night shift when the contents of a mixing machine caught fire. Hall opened the lid of the machine, burning his hand in the process, and then Hudson and he calmly emptied buckets of sand on to the mixture. They extinguished the fire before the factory brigade arrived on the scene.

Obituary

MR. DAVID PATERSON, F.R.S.E., who died at St. Andrews on April 1, had until recently been employed as colour chemist at the Roslin Carpetworks, Midlothian.

MR. ROBERT EDWARD PALMER, O.B.E., M.Inst.M.M., who died on April 6, aged 78, was for many years technical adviser to the Rio Tinto Company. He was chairman of the Tigon Mining and Finance Corporation, Ltd.

MISS HOPE CONSTANCE MONICA WINCH, A.R.I.C., who met her death from a fall of 150 ft. while rock-climbing on a buttress of Deep Ghyll, Scafell, on April 8, was the founder and head of the pharmacy department of Sunderland Technical College. She had been an Associate of the Royal Institute of Chemistry since 1920.

General News—From Week to Week

Open-cast mining in Britain yielded 4,426,700 tons in 1943. Up to March 22, this year's output has been 1,427,000 tons.

A trailer pump team from BX Plastics, Ltd., has won first place in a fire-fighting competition held in the Eastern Region.

Peat and turf are being used by factories in Eire to replace the coal lost through the virtual stoppage of imports from England.

Fires in factories last year caused damage to the tune of over £9,000,000, though this was £3,378,000 less than in 1942.

The railings campaign in Britain has yielded 577,427 tons of scrap. £55,000 has had to be paid in compensation incurred in connection with it.

Development of central steam and hot-water supply stations was urged by Mr. H. E. Partridge, addressing a Glasgow meeting of the Institution of Engineers. He thought it true to say that in the past coal had been too cheap—a cause for the prodigal waste of this raw material.

Mr. R. A. Butler, President of the Board of Education, has announced that a departmental committee has been set up, under the chairmanship of Lord Eustace Percy, to review the relation of universities to technical colleges in the field of higher technological education.

The ban on publication of certain commercial statistics must remain. This was the Government's answer to the suggestion made in the House of Lords by a former president of the F.B.I., Lord Barnby, who suggested that publication of statistics to help industrialists in formulating future plans should be allowed.

A parliamentary question elicited the statement from the Under-Secretary of State for Dominion Affairs that damage to property was done by strikers in the Havelock asbestos mines, Swaziland, recently. The strike, he said, appeared to have been due to dissatisfaction of some native employees with the management of the mine. Steps were taken to deal with their complaints.

The British Government is far from satisfied with the present position with regard to Portuguese exports of wolfram to Germany. This admission was made by Mr. Dingle Foot in the House last week. Mr. G. Strauss had pointed out that these exports were 20 times greater than before the war, and had already caused the death of thousands of our soldiers. From America it is reported that the Department of State is sending Mr. William George, a specialist on Iberian affairs, to try to break the present deadlock.

The White Paper on Scientific Research and Development (H.M.S.O., 2d.) describes existing Government machinery for the promotion of the activities mentioned in its title. It is hoped that it will prove a useful background for the discussion, which is to take place in the House of Commons next week, on this important field after the war.

Alternatives to sulphuric acid for the control of weeds are discussed by Mr. G. E. Blackman in the April issue of the journal of the Ministry of Agriculture. He refers to copper sulphate, cyanamide, and dinitro-ortho-cresol compounds. According to this author a 0.8 per cent. solution of the ammonium salt of dinitro-ortho-cresol is capable of killing many annual weeds.

More than 24 million parcels of food and comforts have now been sent to the 150,000 British prisoners and internees in German prison camps by the Red Cross and St. John at a cost of some £14,000,000. Towards the cost of this and many other Red Cross services, contributors to the Red Cross Penny-a-Week Fund are raising an average of £120,000 every week.

The function of factory canteens as works relations centres was mentioned by Sir Francis Joseph in his address to the National Society of Caterers to Industry. He said that during the war canteens had become propaganda centres, and the aim should be to ensure that they were centres not of political agitation, but of good works relations.

Marsh gas is stated to have been the cause of an explosion that led to the death, last month, of two employees of the Clyde Navigation Trust while working inside a diving-bell on the bed of the river. Mr. W. Cuthbert, chairman of the Trust, said that such a thing had never happened before, and their officials were giving the matter their closest attention, including the circulation of inquiries among other harbour authorities.

Foreign News

Argentina's sulphur output last year was 18,000 tons. Production this year should be double that figure, and an exportable surplus is anticipated.

A new *p*H indicator, ethylbis-2,4-dinitrophenylacetate gives an accurate end-point in amber-coloured solutions where the phenolphthalein end-point is not visible, and is therefore suitable for use in determining the acid numbers and saponification equivalents of dark-coloured oils. Its preparation and properties are described by E. A. Fehnel and E. D. Amstutz in *Ind. Eng. Chem.* (Anal. Ed., Jan. 1944, p. 53).

Totaquin is being produced in British East Africa's first quinine factory, situated at Dar-es-Salaam, Tanganyika.

Canada last year used 200,000,000 gallons of creosote to impregnate 3700 million board feet of lumber.

A dehydrated castor oil plant with a monthly capacity of 60,000 lb. is being erected in Brazil.

New chemical works started in Switzerland in 1942 numbered 23, states the annual report of the Swiss Industrial Inspectorate.

Caffeine is being produced by at least eight Brazilian firms. The principal producer, a firm in S. Paulo, turns out 18,000 kg. a month.

A plant for making pentaerythritol explosives is being established by Bofors, the Swedish munitions concern, which is also starting experimental production of plastics.

Two quinine-extraction plants are being installed at Costermansville, Belgian Congo. 7.5 tons of quinine sulphate will be their joint target for 1945.

Iron mines at Divrik, Turkey, have yielded 457,373 tons of ore in the last five years. Previously an importer of pig iron, Turkey is now said to be able to export this material.

Dominion Industries, Ltd., of Auckland, New Zealand, a subsidiary of Fletcher Holdings, Ltd., is shortly to produce phenolic resins for adhesive purposes. Later the company may make moulding powders.

World shortage of bismuth has led the New Zealand Medical Supplies Controller to prohibit the sale of bismuth salts to any except wholesalers, dentists, and members of the medical and pharmaceutical professions.

Turkish chrome exports to Germany have increased threefold since the beginning of this year. It is estimated that from January 1 Germany has taken delivery of some 25,000 tons of chrome. Total deliveries for the whole of 1943 were 30,000 tons.

German imports of bauxite from Hungary now amount to 600,000 tons a year, stated a Ministry of Economic Warfare spokesman (*see* THE CHEMICAL AGE, April 1, 1944, p. 317) at a Press conference last week. Hungary's annual output is said to be 900,000 tons.

The rare mineral, thenardite, now filling requirements previously met by imported salt cake, has been found in beds 1-4 ft. thick below the salt crystallising pans at Didwana, Jodhpur State, India. The deposit, estimated at 250,000 tons and accumulated over a period of 150 years, is remarkably free from sodium chloride, an average analysis for 3-400 tons giving NaCl 0.80 per cent. The mode of formation of the deposit was discussed at the last meeting of the British Mineralogical Society.

South African Alkali, Ltd., for the quarter ended December 31, report that the amount of brine pumped was 3,468,785 gallons, and brine refrigerated 1,554,000 gallons. Soda ash produced was 595 tons, and salt 785 tons, Soda ash sold was 400 tons and salt 630 tons. Compared with previous quarter, soda production fell 15 tons and sales 91 tons. Salt production was down 25 tons and sales were 138 tons lower.

The total mine production of recoverable lead and zinc in the United States and Alaska (including that made into pigments and chemicals direct from ore) in 1943 was 446,348 short tons of lead and 740,587 short tons of zinc, according to preliminary figures of the United States Bureau of Mines. These figures indicate decreases of 10 per cent. in the production of lead and 4 per cent. in the production of zinc, compared with 1942.

Radio-frequency heating, as used to promote the case-hardening of steel, the thermosetting of glue and the bonding of thermoplastic materials, is an expensive method of heat production and can be used consistently only where conditions are such that the cost of heat involved is not to be considered. This view was expressed by Dr. G. H. Brown, of R.C.A. Laboratories, addressing the Ceramic Association of New Jersey.

Asbestos-filled moulding systems have extensively replaced hard rubber and other plastics in aircraft systems, said Mr. R. J. Romieux at a recent plastics conference held in Toronto. He described them as having greatly contributed to the improved performance of combat aircraft under extremes of temperature and humidity. They are not damaged by the action of nitric acid, which is formed within ignition parts at high altitudes.

The chemical composition of Malabar tallow, obtained from the seeds of *Vateria indica*, is described in two papers by C. Venkatarao and M. Narasingarao in the *Journal of the Indian Chemical Society* (July and September, 1943). The glyceride structure shows similarities with that of Borneo tallow, but the authors suggest it should find a more favourable place in confectionery on account of its pleasant smell, and it can be used in soap-making and as a source of stearic acid.

Fourteen American firms, including such well-known concerns as Parke Davis & Co., E. R. Squibb & Sons and Winthrop Chemical Co., are contesting an Office of Price Administration order regulating the price of vitamins. This would reduce retail prices about 15 per cent. below the prices in effect in October, 1941. The O.P.A. holds that whereas primary producers of synthetic vitamins have reduced their selling prices by 64 per cent., the fall in the retail price has been only 9.5.

Forthcoming Events

The Tees-side Sections of the **Royal Institute of Chemistry** and the **Society of Chemical Industry** are holding a joint meeting on **April 15,** at 2.30 p.m., when Dr. U. R. Evans is to lecture on "Some Researches into Metallic Corrosion."

The annual meeting of the **Institution of the Rubber Industry,** London section, will be held on **April 17** at 6.30 p.m. at the Imperial Institute, South Kensington.

Dr. Guter will lecture on "Science and the Soviet" at the meeting of the Tees-side Section of the **British Association of Chemists,** to be held in the Y.M.C.A. Rooms, Stockton, on **April 17** at 7 p.m.

Members of the **Royal Institute of Chemistry,** Glasgow Section, have been invited to the meeting to be held in Room 24 of the Royal Technical College, Glasgow, at 7 p.m. on **April 17,** when an address entitled "Rare Elements in Coal Ashes" will be given by Professor V. M. Goldschmidt.

The British Association of Chemists, Sheffield Branch, meets on **April 17** at 6.30 p.m. in the City Central Library, when the popular topic of "Plastics" will be introduced by two films showing the manufacture and uses of two types of these substances. The chair will be taken by Mr. H. W. Rowell, M.I.Chem.E., a well-known expert on plastic materials, who will lead the discussion which will follow the films.

The annual meeting of the **Textile Institute** will be held at the Midland Hotel, Manchester, on **April 19.**

The Institute of Fuel meets in Manchester at the Engineers' Club, Albert Square, on **April 19** at 2.30 p.m., to hear a paper by Mr. A. C. Dunningham and Mr. B. M. Thornton dealing with "Mechanical Stokers on Small Boilers."

Sir Francis Joseph will speak on "The Future of the Coal Industry" at the public discussion meeting of the **Society of Individualists** to be held at the College of Preceptors, Bloomsbury Square, London, W.C.1. on **April 20** at 2.30 p.m.

A paper on "Polyvinyl Chloride" will be presented by Mr. D. N. Davies, B.Sc., A.M.I.Chem.E., to the meeting of the **Institute of the Plastics Industry** arranged for **April 20** at 6.30 p.m. at the Waldorf Hotel, Aldwych, London. Members of the Plastics Group of the S.C.I. are invited.

The **Institute of Fuel** will meet in the rooms of the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, at 2.30 p.m. on **April 20** when Dr. A. Parker, Director of Fuel Research, will present a paper entitled "The Organisation of a Research Department," to be followed by a discussion.

The 103rd annual meeting of the **Chemical Society** will be held at Burlington House, Piccadilly, W.1. on Thursday, **April 20.** At 11.30 a.m. the business portion of the meeting will take place (for Fellows only). At 2.30 p.m., Dr. W. H. Mills, F.R.S., will deliver his presidential address entitled "Old and New Views on Some Chemical Problems."

A meeting of the **International Society of Leather Trades' Chemists,** Manchester Group, has been arranged for **April 22** at 1 p.m. in the Engineers' Club, Albert Square. Dr. Laurence Okell will talk on acids and salts in tanning liquors, and Mr. G. H. W. Humphreys will present a paper dealing with recent advances in leather manufacture.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

COX & DANKS, LTD., London, N.W., metal merchants. (M., 15/4/44.) March 20, mortgage and charge, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on certain land at Tipton with machinery, etc., and a general charge. Bank mortgages, October 18, 1943.

Company News

The Dominion Tar and Chemical Company reports a net profit of $672,724 ($680,307) for the year ended December 31.

Worthington-Simpson, Ltd., announce a net profit for 1943 of £21,106 (£20,607), and an ordinary dividend of 7 per cent. (same).

Benzol and By-Products, Ltd., announce a net profit, to September 30 last, of £34,672 (£22,443). Arrears of preference dividends up to March 31, 1934, have been paid.

Indestructible Paint, Ltd., have again declared a final dividend of 17½ per cent., making 25 per cent. (same) for the year to December 31. Net profit was £44,501 (£46,766).

Stewarts and Lloyds, Ltd., are again paying a dividend of 12½ per cent. on the deferred stock, and the usual half-yearly payments on the three classes of preference capital are announced.

The United Turkey Red Co., Ltd., records a profit, for the year ended December 31, of £88,620 (£68,834). One year's arrears on the 4 per cent. cumulative preference shares (in arrears from December 31, 1937) is to be paid on May 1.

Pinchin Johnson and Co., Ltd., announce a net profit for 1943 of £183,768 (£183,131), after a deduction of £370,000 (£270,000) for taxation. The final ordinary dividend is 7½ per cent., making 10 per cent. (8½ per cent.)

New Companies Registered

J. Campbell Harry & Co., Ltd. (866,645).—Private company. Capital: £2000 in 2000 shares of £1 each. To acquire the business of a consulting, analytical, sampling and manufacturing chemist, at 183 Cathedral Road, Cardiff, as "J. Campbell Harry & Co" Directors: J. Campbell Harry, H. Roland Harry, Muriel Harry and Eileen Harry.

Dyers' Research Ltd. (386,665).—Private company. Capital £100 in 100 shares of £1 each. To carry on the business of dyers, bleachers, manufacturers of and dealers in bleaching and dyeing materials, research and analytical dyers and chemists, etc. Subscribers: J. D. Gordon Whitchell; W. R. Hankinson. Registered office: 1a, Manor Row, Bradford.

Association of Manufacturers of Bituminous Protective Products, Ltd. (386,463).—Registered as a company limited by guarantee without share capital, to protect the interests of manufacturers of bituminous protective or ancillary products. Subscribers: T. W. Mathias (Colas Products); C. Montagu Smith (Burt, Boulton and Haywood); I. Cameron (British Bitumen Emulsions); A. B. C. Licence (Berry, Wiggins and Co.); S. W. Grieg (British Paints); W. A. Edwards (Dryamels); M. A. H. Dick (Wailes Dove Bitumastic). Solicitors: Theodore Goddard and Co., 5 New Court, London, W.C.2.

Chemical and Allied Stocks and Shares

STOCK markets have been firm under the lead of British Funds, which showed a number of fractional gains, although there was little improvement in the volume of business. Imperial Chemical remained steady at 38s. 7½d. awaiting the impending dividend statement. British Aluminium were better at 47s. 7½d. and, pending the full results and chairman's annual statement, British Oxygen continued steady at 79s. In the plastics field attention again centred mainly on De La Rue, which rose further to 173s. 9d. British Industrial Plastics 2s. ordinary were again 6s. 7½d. and Erinoid 11s. Turner & Newall continued in steady demand, and at 82s. 3d. recorded a further gain on balance. Paint shares remained firm, aided by the favourable impression created by dividend announcements. Following maintenance of the distribution at 25 per cent., Indestructible Paint were quoted at 120s. Moreover, the increased dividend and large improvement in profits were reflected by firmness in Pinchin Johnson 10s. shares at 35s. Paripan 5s. ordinary changed hands up to 28s. on publication of the full results, which confirms the maintenance of the dividend at 25 per cent.

Iron and steel securities have well maintained recent gains. Stewarts & Lloyds were 55s. on repetition of the dividend at 12½ per cent., which the results will no doubt again show to be a conservative payment. Hopes of a better dividend on Richard Thomas 10s. ordinary resulted in a further improvement of the price to 10s. 6d. Tube Investments have been firm at 96s. 3d., as have Babcock & Wilcox at 50s., while Hadfields were 30s. 7½d. and United Steel strengthened to 25s. Allied Ironfounders were 50s. 4½d., Dorman Long 27s., Guest Keen 35s. 9d., and Consett Iron 6s. 8d. units were at 7s. 4½d. Amalgamated Metal kept at 17s. 6d. and Goodlass Wall at 17s. 3d.

In other directions, British Plaster Board strengthened to 30s. 4½d., while Associated Cement were 63s. Following an earlier rise, United Molasses eased to 33s. 1½d. but remained active. The units of the Distillers Co. were better at 89s. and, in other directions, there was a further small gain in Imperial Smelting at 14s. Under the influence of the higher dividends Anglo-American Asphalt shares rose to 32s. and Tarslag 2s. shares to 4s. 6d. Limmer & Trinidad Asphalt were 53s. 9d. and Ragusa Asphalt 37s. Lawes Chemical 10s. shares marked 12s. 9d. at one time, and Leeds Fireclay preference 16s. 3d. while B. Laporte changed hands up to 78s. 6d. British Glues & Chemicals 4s. ordinary were 7s. 9d., and William Blythe 3s. ordinary around 9s. Elsewhere, Titanine 2s. ordinary marked 6s. 7½d. Cellon 5s. shares were 23s. and British Tar Products 10s.

Among textiles, Courtaulds became firmer at 52s. 10½d., but British Celanese eased to 27s. 3d. Bradford Dyers strengthened to 21s. 3d. Lever & Unilever were better at 35s. 3d., as were Barry & Staines at 45s. 3d., while Nairn & Greenwich were 73s. 9d. Greeff-Chemicals 5s. ordinary remained at 7s. 3d. and Monsanto Chemicals 5½ per cent. preference at 23s. British Drug Houses ordinary were 22s. and Burt Boulton 23s. Murex remained at 102s. 6d. Metal

Box shares were 89s. 4½d. and Wall Paper Manufacturers deferred 38s. 6d. General Refractories 10s. ordinary continued steady at 16s. under the influence of the results.

Boots Drug 5s. units showed steadiness at 42s. 9d. and Timothy Whites were 33s., while Sangers 5s. ordinary were 24s. 10½d. Triplex Glass showed small fluctuations around 37s.; United Glass Bottle were 61s. and Forster's Glass 10s. shares 31s. 3d. Among oil shares, "Shell" have been 75s. and Anglo-Iranian 116s. 10½d., while at 63s. 3d. Ultramar lost part of an earlier improvement. British Controlled ordinary and preference developed activity.

British Chemical Prices

Market Reports

THE London chemical market generally has continued on a very firm basis, and pressure for supplies against contracts is sustained. Fresh buying has been on a moderate scale, with values on a strong basis throughout. Among the soda compounds, solid caustic soda is being taken up against contracts fairly steadily, and there has been a good demand for caustic liquor. There has been no change in the position of industrial refined nitrate of soda, which continues in steady request. Yellow prussiate of soda is a strong market and a brisk demand is reported for supplies of Glauber salt and salt cake. Fresh inquiry for nitrate of soda has been moderate with quotations unchanged. Acetate of soda is steady. Among the potash chemicals British-made permanganate is an active market in both the technical and pharmaceutical grades, while a fair amount of new business has been done in acid phosphate of potash. Distribution of solid caustic potash continues among approved consumers at unchanged levels, and limited supplies of bichromate of potash are quickly absorbed. Little change in trading conditions on the market for coal-tar products has been reported this week, and the demand for the majority of materials has continued on steady lines.

MANCHESTER.—The movements of industrial chemical supplies on the Manchester market during the past week has been noticeably affected by the holidays, but an early steady resumption of the demand for the leading soda products and other materials is confidently anticipated. So far as values are concerned, the position is pretty well the same as it has been during recent weeks, with a generally strong undertone in evidence. Local business in the general run of tar products has also been under holiday influences, though here again quotations are very firm and a ready outlet for the make of most classes of materials is assured.

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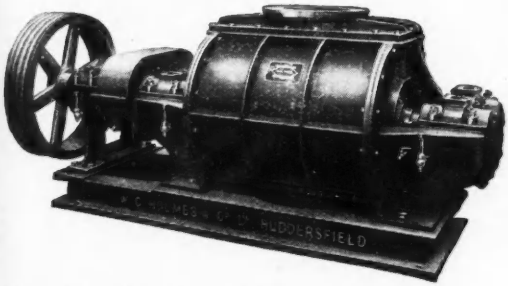

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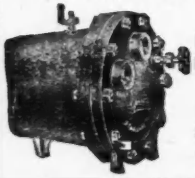
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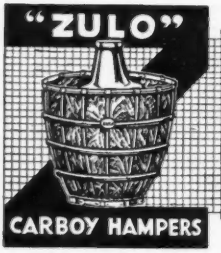
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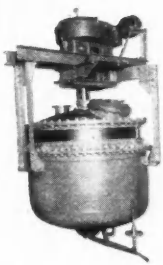

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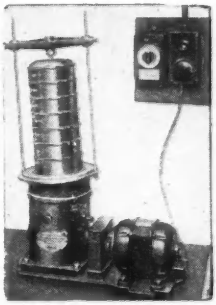

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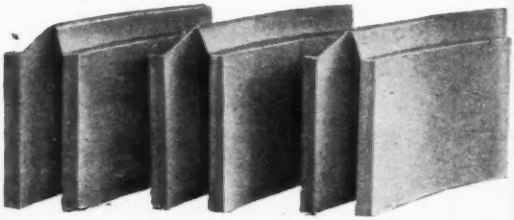

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